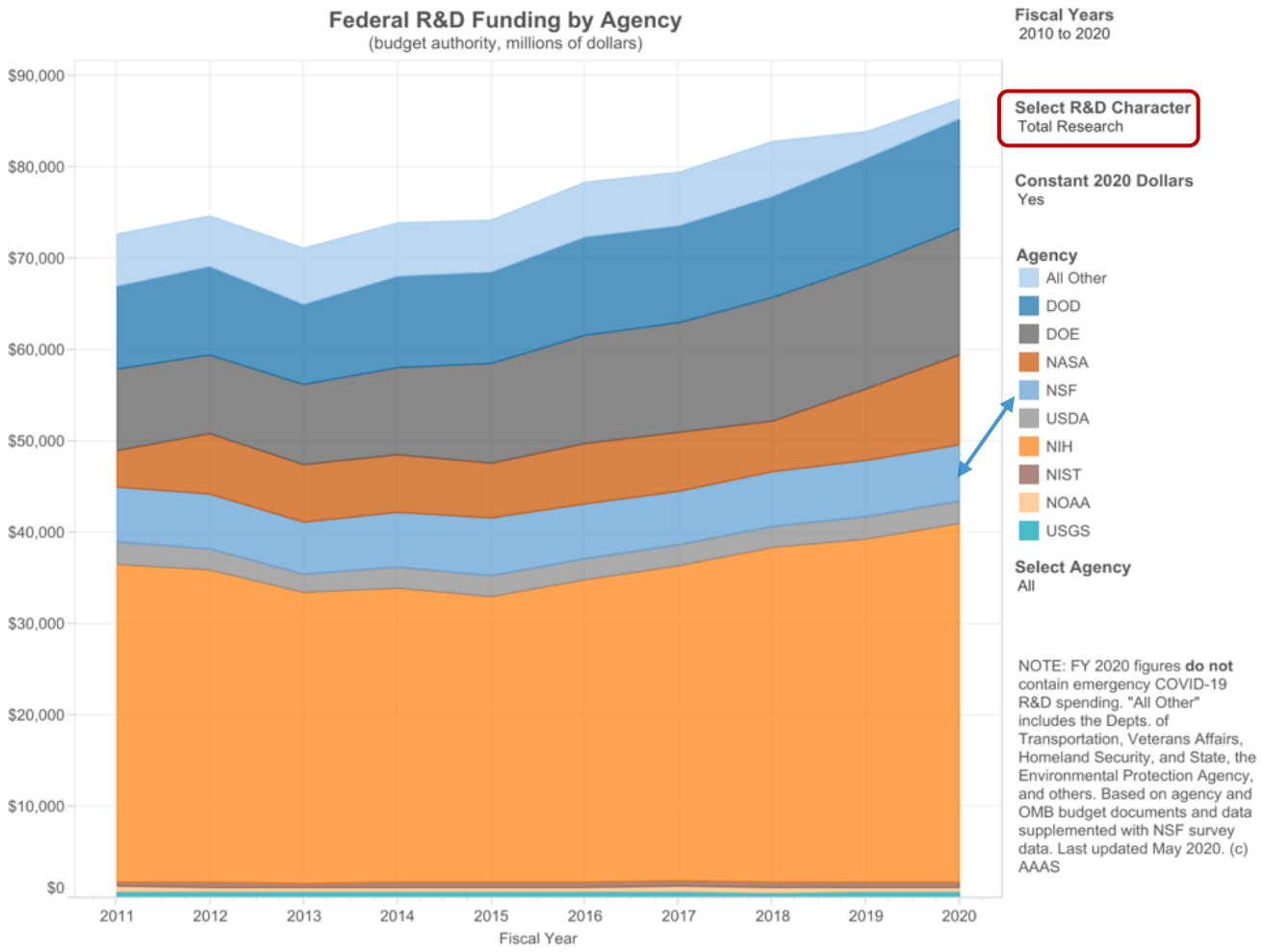
SPACE WEATHER RESEARCH PROGRAM OF THE U.S. NATIONAL SCIENCE FOUNDATION

Dr. Mangala Sharma, Program Director, Space Weather, NSF
www.nsf.gov

Space Weather Workshop (April 20, 2021)

NSF is the only U.S. federal agency that invests in basic research & education across STEM disciplines



Credit: AAAS Federal R&D Budget Dashboard

$8.4 billion	FY 2020 Appropriations (does not include mandatory accounts)
1,421	NSF Employees (Full Time Equivalents in FY 2020)
1,900	Colleges, universities, and other institutions receiving NSF funding in FY 2020
12,200	Competitive awards funded in FY 2020
28%	Funding rate in FY 2020
313,000	Estimated number of people NSF supported directly in FY 2020 (researchers, postdoctoral fellows, trainees, teachers, and students)

NSF'S MISSION

To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

Director's Vision

Advance the frontiers of research into the future

Ensure accessibility and inclusivity

Secure global leadership

We are in a **DEFINING MOMENT**

- Intensity of global competition
- Urgent need for domestic talent
- Broad support for science as path for solving global grand challenges

We can accomplish this vision with:

SPEED AND SCALE

PEOPLE

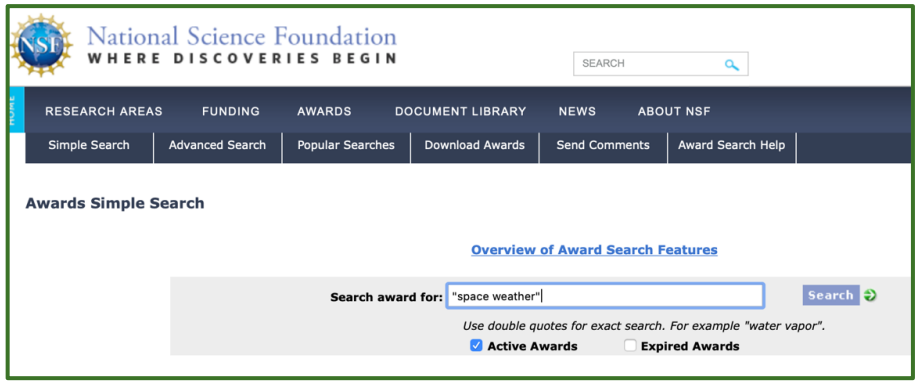
PARTNERSHIPS

NSF

TRANSLATION

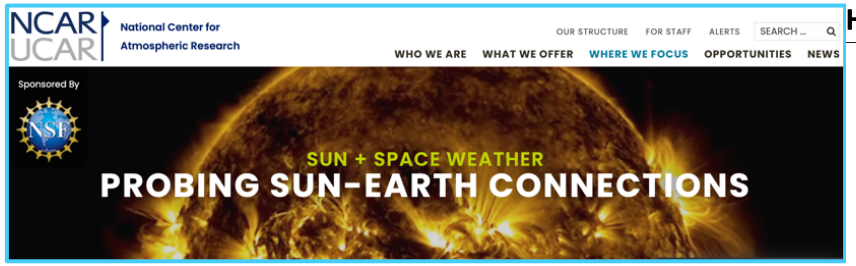
Several NSF programs and units support SWx!

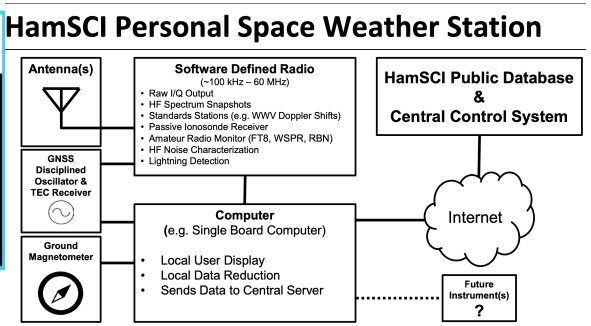
https://www.nsf.gov/awardsearch



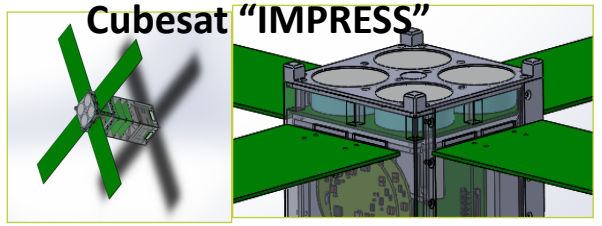
NSF Organization

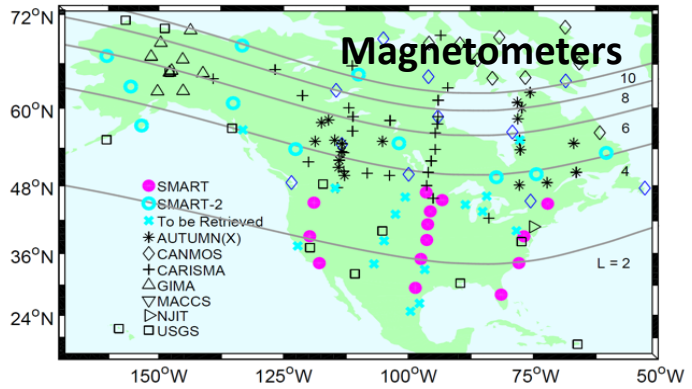
- Office Of The Director(3)
  - Office of Integrative Activities(3)
- Direct For Mathematical & Physical Scien(31)
  - Division Of Physics(17)
  - Division Of Astronomical Sciences(12)
  - Division Of Mathematical Sciences(2)
- Direct For Computer & Info Scie & Enginr(12)
  - Office of Advanced Cyberinfrastructure (OAC) (12)
- Directorate For Geosciences(232)
  - ICER(9)
  - Div Atmospheric & Geospace Sciences(212)
  - Division Of Earth Sciences(3)
  - Office of Polar Programs (OPP)(8)
- Directorate For Engineering(1)
  - Div Of Industrial Innovation & Partnersh(1)

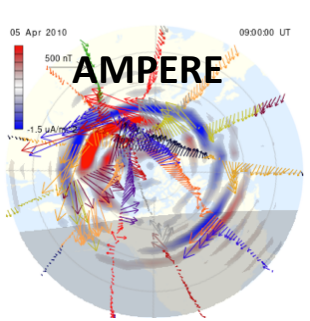


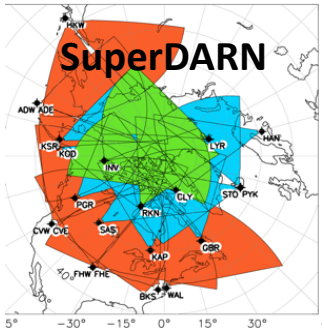


Credit: NSO/NSF/AURA



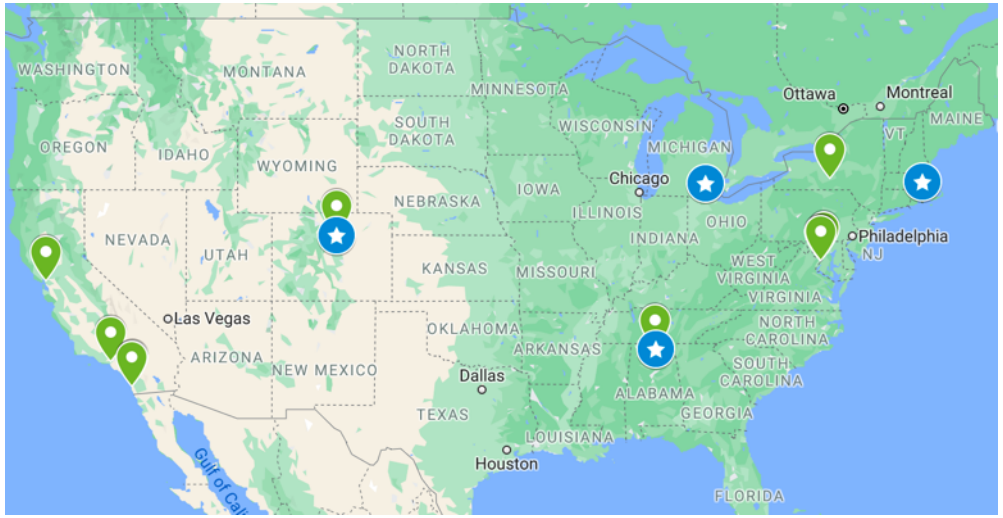






NSF and NASA made 6 awards totaling >$17M (FY20) for *Next Generation Software for Data-driven Models of Space Weather with Quantified Uncertainties*

- *(NASA)* Ensemble Learning for Accurate and Reliable Uncertainty Quantification (PI: E. Camporeale, CU Boulder [+ UCLA])
- *(NSF)* Forecasting Small-Scale Plasma Structures in the Earth's Ionosphere-Thermosphere System (PI: T.-W. Fang; CU Boulder [+ Cornell U.])
- *(NSF)* Composable Next Generation Software Framework for Space Weather Data Assimilation and Uncertainty Quantification (PI: R. Linares, MIT [+ UCSD, U. Michigan])
- *(NSF+NASA)* Improving Space Weather Predictions with Data-Driven Models of the Solar Atmosphere and Inner Heliosphere (PI: N. Pogorelov, U. Alabama at Huntsville [+ GSFC, MSFC, LBNL, PSI, SSRC])
- *(NASA)* A Flexible Community-based Upper Atmosphere Ensemble Prediction System (PI: A. Ridley, U. Michigan [+ UCAR, GSFC, NRL])
- *(NSF)* NextGen Space Weather Modeling Framework Using Data, Physics and Uncertainty Quantification (PI: G. Toth, U. Michigan)



- Understand necessary and sufficient requirements of model complexity, computational performance, and observational inputs for predictive space weather modeling
- Transdisciplinary collaborations among universities, national labs, private sector

nature physics

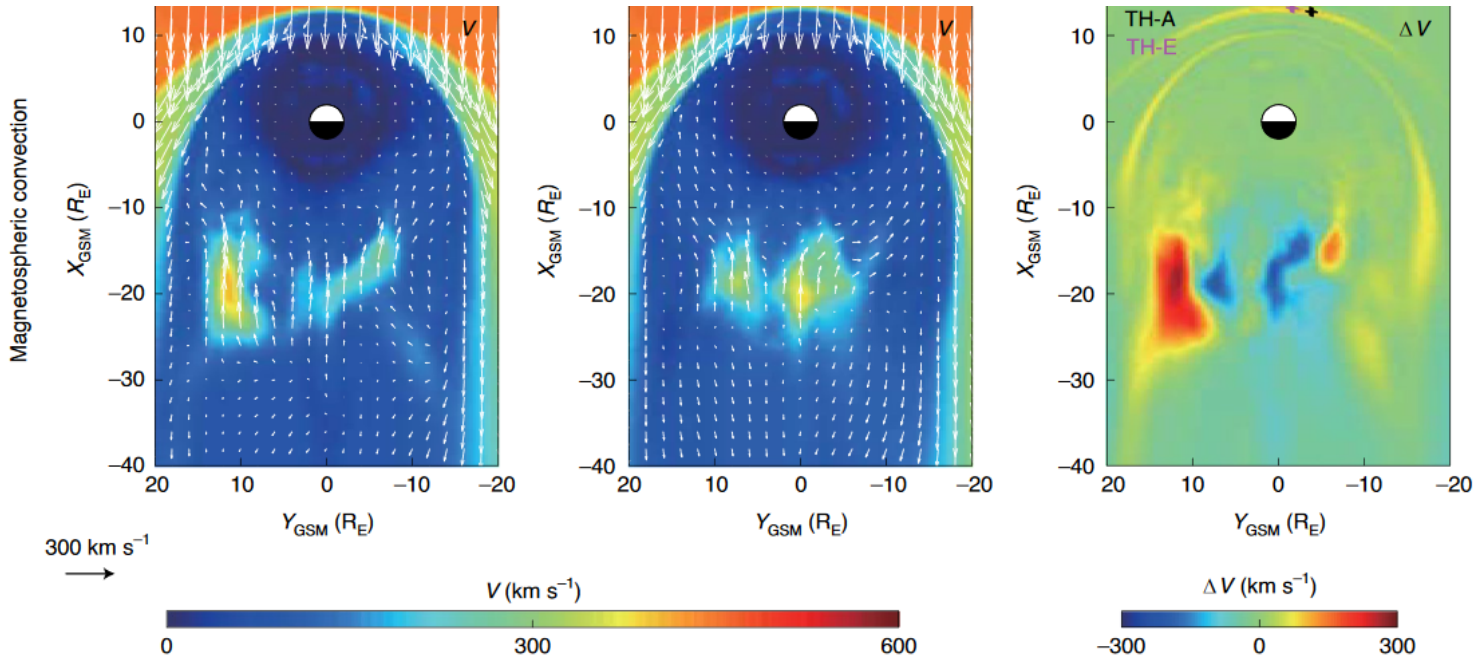
LETTERS

https://doi.org/10.1038/s41567-021-01203-5

Check for updates

Solar flare effects in the Earth's magnetosphere

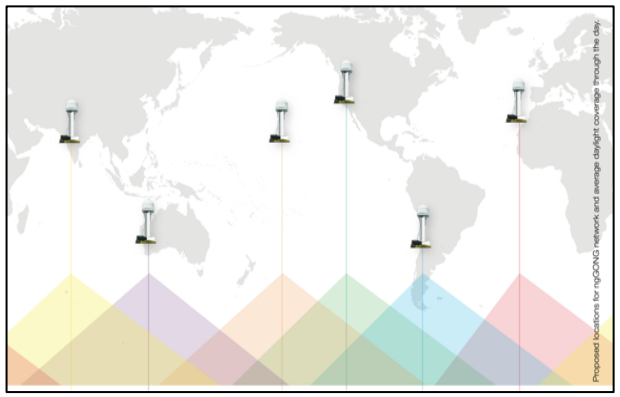
Jing Liu[1]✉, Wenbin Wang[2], Liying Qian[2], William Lotko[2,3], Alan G. Burns[2], Kevin Pham[2], Gang Lu[2], Stanley C. Solomon[2], Libo Liu[4], Weixing Wan[4], Brian J. Anderson[5], Anthea Coster[6] and Frederick Wilder[7]

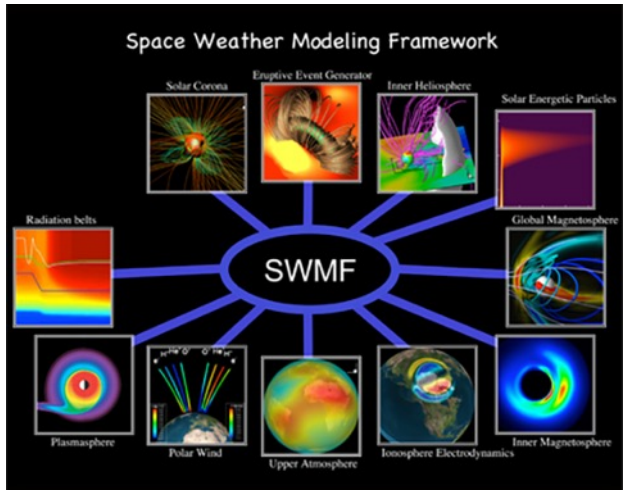


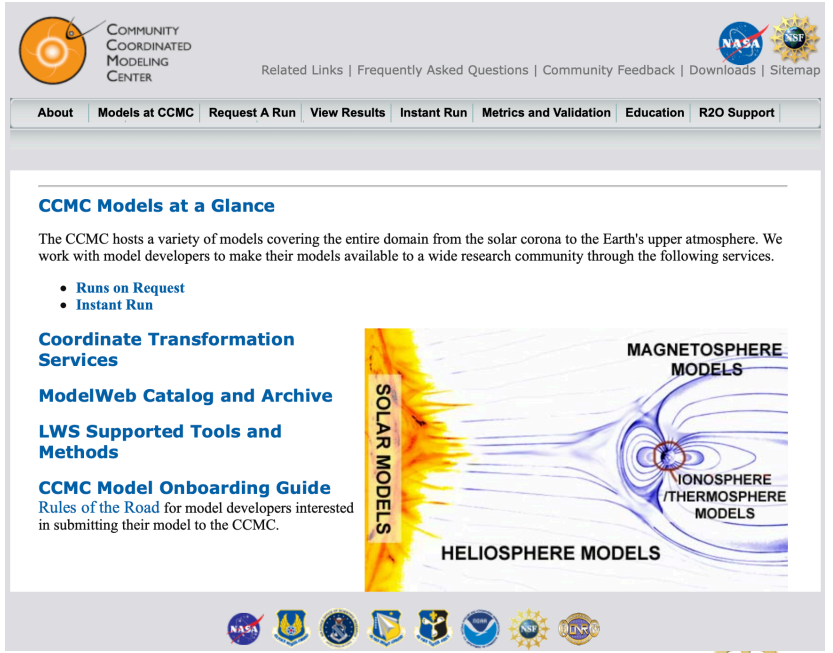
NSF supports SWx research *and* applications

- Multi-agency (NOAA, NASA, NSF, DoD) partnership supporting R2O2R activities
- Considering future pathways for observing systems (e.g., GONG and Neutron Monitors)
- Exciting new solicitation: ***Grand Challenges in Integrative Geospace Sciences: Advancing National Space Weather Expertise and Research toward Societal Resilience*** (ANSWERS)

GONG







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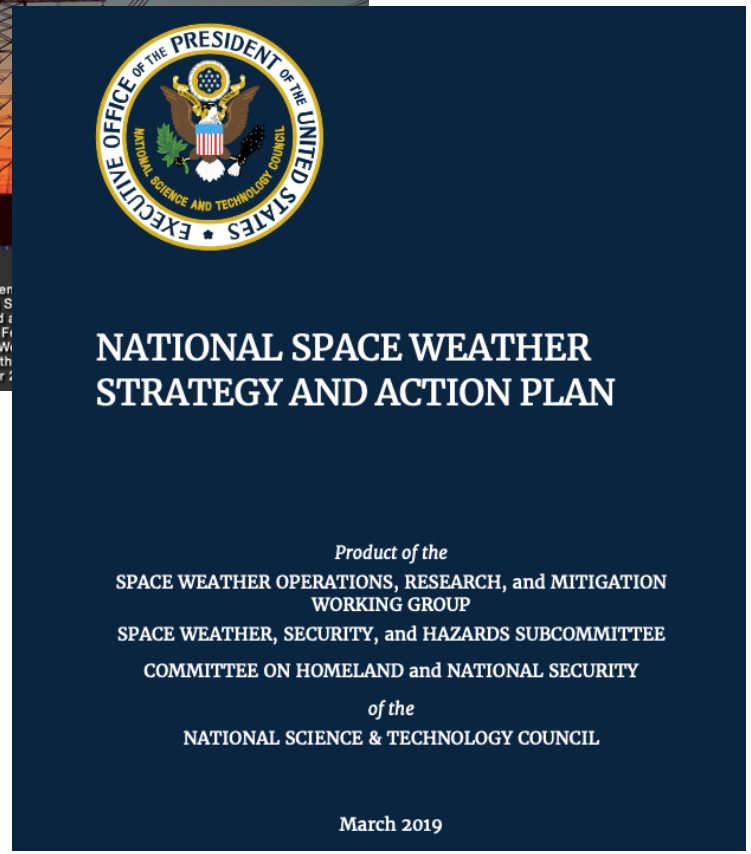
Space Weather Policy and Implementation



Public Law No: 116-181: Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow (PROSWIFT) Act

directs NSF, NASA & NOAA to:

- continue to support basic research in disciplines relevant to space weather
- sponsor a National Academies "Space Weather Government-Academic-Commercial Roundtable" for communication and knowledge transfer
- establish 15-member Space Weather Advisory Group (5 each from academia, commercial sector, non-governmental end-user community)

- Directs NSF specifically to
  - "maintain and improve ground-based observations of the Sun" and
  - "continue to provide space weather data through ground-based facilities"

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Diversity has long been a top priority for NSF

Agency performance goal: *to expand efforts to increase participation from underrepresented groups and diverse institutions throughout the United States in all NSF activities and programs.*

- NSF Broadening Participation Portfolio - www.nsf.gov/od/broadeningparticipation/bp_portfolio_dynamic.jsp
- DCL: Opportunities for Mid-Career Scientist Support in the Atmospheric and Geospace Sciences - www.nsf.gov/pubs/2021/nsf21018/nsf21018.jsp
- GEO Opportunities for Leadership in Diversity (GOLD) - www.nsf.gov/funding/pgm_summ.jsp?pims_id=505271

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We look forward to strong space weather partnerships with academic, private sector, government, and international partners

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U.S. National Science Foundation